

REMARKS

This is in response to the Official Action currently outstanding with respect to the above-identified application, which Official Action the Examiner has designated as being FINAL.

Claims 1-22 were present in this application as of the time of the issuance of the currently outstanding FINAL Official Action. Claims 1-21 currently stand rejected by the Examiner. Claim 22 stands allowed. Applicants request the entry of the foregoing Amendment of Claim 1 so as to place this application in condition for allowance, or at least in better form for Appeal, pursuant to 37 CFR 1.116. Applicants propose that no new claims be added, and that no claim be withdrawn or canceled by the foregoing Amendment. Accordingly, in the event that the Examiner grants the entry of the foregoing Amendment, Claims 1-22 as hereinabove amended will constitute the claims under active prosecution in this application.

The claims of this application are reproduced above including appropriate status identifiers and showing the Amendments sought as required by the Rules.

More specifically, it is noted that in the currently outstanding Official Action, the Examiner has:

1. Acknowledged Applicants' claim for foreign priority under 35 USC §119(a)-(d), and reconfirm that the required certified copies of the priority document have been received by the United States Patent and Trademark Office;
2. Indicated that the drawings filed on 28 April 2006 have been accepted;
3. Objected to Claim 1 because "the axial path" lacks proper antecedent basis,
4. Rejected Claims 1-21 under 35 USC §103(a) as being unpatentable over Minamio et al., (U.S. Patent 6,864,117) in view of Fukasawa et al. (U.S. Patent No. 6,396,082);
6. Provided Applicants with her Response to their Previous Arguments.

Further comment in these Remarks regarding items 1-2 above is not considered to be necessary in these Remarks.

With respect to item 3, Applicant agrees with the Examiner's observation that the term "axial" does not find appropriate antecedent basis in the claims. In the last Amendment in this application, the word "optical" that originally appeared in Claim 1 was inadvertently misstated as "axial". By the foregoing Amendment, Applicants have corrected this error by changing the word "axial" to -- optical-- in Claim 1. Entry of this amendment of Claim 1 to correct this typographical error in response to this submission is respectfully requested.

Applicants appreciate the Examiner's thorough examination of the subject application and respectfully requests entry of the foregoing Amendment and reconsideration of the subject application based on the foregoing amendments and the following remarks as placing this application in condition for allowance, or at least in better form for Appeal, pursuant to 37 CFR 1.116..

In the above regard, Applicants respectfully note that they propose by the foregoing Amendment that Claim 1 be amended so as to specifically indicate that (1) that the claimed mounting body has high thermal conductivity; and (2) that "... the optical surface of the optical element is attached to a surface portion of the mounting body in a manner establishing high thermal conductivity therebetween." Applicants respectfully submit that the foregoing Amendments are proper at this stage of this prosecution because as will appear more fully below they are fully supported by the specification as originally filed, and it is believed that the Examiner in view of his prior searches in regard to this application would not have to engage in any further significant consideration and/or search in connection with the entry of the foregoing Amendment and the allowance of this application.

More specifically, support for the amendments proposed above is found in the present specification as follows:

The optical element 22 blocks one end portion 48 of the light transmitting section 38 in its axis direction, and is attached to a surface portion 39 of the optical element mounting section 34 on the side in one thickness direction A1. Herein, the one end portion 48 of the light transmitting section 38 in the axis direction serves as a side end portion of the light transmitting section 38 on the side in one thickness direction A1.

The optical element 22 is provided with an optical surface 41. When the optical element 22 is a light-emitting element, e.g., LED, the optical surface 41 serves as a light-emitting surface. When the optical element 22 is a light-receiving element, e.g., PD, the optical surface 41 serves as a light-receiving surface. The optical surface 41 is directed to the light transmitting section 38 from the side in one thickness direction A1, and is disposed on the extension line of the optical path 80. As such, the optical element 22 is so disposed that the optical surface 41 faces the optical element mounting section 34 of the lead frame 30. Such placement of the optical element 22 and the lead frame 30 is sometimes referred to as face-down placement. (Page 27, line 7 to Page 28, line 4 and Fig. 1).

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This enables to easily transfer the heat generated on the optical surface 41 to the optical element mounting section 34, and the heat dissipation characteristics of the optical element 22 can be made better. As a result, the operating temperature of the optical element 22 can be reduced so that the optical element 22 can be stably operated even under the high temperature environment. Moreover, the stress to be produced in the optical element 22 can be reduced while suppressing the heat expansion of the optical element 22 so that the optical element 22 can be protected from any possible damage.

When an LED is used for the optical element 22, the optical surface 41 serving as an active surface layer of the LED produces heat. The optical element 22 is thus large in heat resistance. Therefore, with the conventional face-up placement, i.e., with the placement in which the surface opposite the optical surface 41 is attached to the lead frame 30, the heat transmission rate is low from the optical surface 41 to the optical element mounting section 34, and the heat dissipation characteristics are thus poor.

On the other hand, in the invention, with the face-down placement in which the optical element 22 is attached to the lead frame 30, the heat is transferred from the optical surface 42 directly to the lead frame 30 without going through the optical element 22. With such a configuration, the heat dissipation characteristics of the optical element 22 can be made better. Especially when the optical element 22 is made of gallium arsenide (GaAs), the heat resistance is high so that the heat dissipation characteristics of the optical element can be improved to a further degree.

With the face-down placement, a surface portion 46 of the optical element 22 is in contact with the lead frame 30 on a side in the other thickness direction A2. This thus eliminates the need to use the sealing body 29 for sealing the neighboring portion of the optical surface 41. With such a configuration, even if the optical element 22 is small in size, there is no more need to dispose the sealing body 29 in the neighboring portion of the optical surface 41 so that the sealing structure 20 can be manufactured with ease.

When the optical element 22 and the optical element mounting section 34 are electrically connected to each other, for attachment of the optical element 22 and the optical element mounting section 34, it is preferable to use an adhesive material with electrical conductivity for attachment of the optical element 22 to the optical element mounting section 34. This achieves to attach the optical element 22 to the optical element mounting section 34 in one operation while establishing an electrical connection therebetween.

What is more, among any highly-conductive adhesives, using a material of a high thermal conductivity or a thin film material will lead to sufficient heat contact. It is more preferable if the adhesive can absorb any difference between the linear expansion coefficient of the lead frame 30 and that of the optical element. For example, such an adhesive material can be implemented by silver paste or solder paste. Alternatively, eutectic gold bonding will do for attachment of the optical element 22 to the optical element mounting section 34.

(Page 35, line 2 to Page 37, line 13).

Accordingly, Applicants respectfully submit that it is self-evident that, because the mounting body is made of metal or Si with high thermal conductivity, rather than being made of resin with low thermal conductivity, the heat dissipation characteristics can be made better.

Applicants respectfully submit that neither the Minamio nor the Fukasawa reference whether taken alone or in combination with one another teach, disclose or suggest all of the features of the present invention now specifically set forth in Claim 1 (and by inference, the claims dependent therefrom). In particular, reference to the Minamio reference indicates that an image element 4, corresponding to the optical element of the present invention, is attached to the base 1 and a wiring 3 via a sealing resin 6 and a bump (protrusion electrode) 7. Accordingly, since a sealing resin such as that disclosed by Minamio is not highly thermally conductive and the surface area of contact between the bumps (protrusion electrodes) 7 of the Minamio reference provide at best a very small area of contact between the image element 4 and the wires 3 that is not highly thermally conductive of a heat build up in the image element 4 away from the image element 4 disclosed in the Minamio reference, Applicants respectfully submit that the Minamio reference does not teach, disclose or suggest the presently amended claims of this application.

Further, Applicants respectfully submit that the situation is similar as it applies to the Fukasawa reference wherein the imaging element 29 is completely surrounded by a sealing resin or a transparent adhesive (neither of which being highly thermally conductive).

Consequently, Applicants respectfully submit that the Minamio and Fukasawa references whether taken alone or in combination with one another are insufficient to teach, disclose or suggest to one of ordinary skill in the art the improvements in the heat dissipation characteristics achieved by the present invention.

Accordingly, Applicants respectfully submit that the present invention should be recognized to have novelty and to be nonobvious over the references currently at issue. Entry of the foregoing Amendment, reconsideration and allowance of this application as hereinabove amended, therefore, are respectfully requested in response to this communication.

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USSN: 10/577,304
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Applicants believe that additional fees are not required in connection with the consideration of this response to the currently outstanding Official Action. However, if for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge and/or credit Deposit Account No. **04-1105**, as necessary, for the correct payment of all fees which may be due in connection with the filing and consideration of this communication.

Respectfully submitted,

Date: February 27, 2008

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SIGNATURE OF PRACTITIONER

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